

REMARKS

In the above-identified office action the Examiner has rejected claims 1-5 and 9-11 under 35 U.S.C. § 112 for claiming a relatively defect-free silicon single crystal. This phrase has been deleted from the claims and accordingly they are now considered definite under 35 U.S.C. § 112.

Claim 7 has been rejected under 35 U.S.C. § 112 as containing subject matter not described in the specification. The Examiner has indicated that there is no teaching of the control means. The use of the term "control means" has been deleted from the claims and accordingly, claim 7 is now considered acceptable under 35 U.S.C. § 112.

Claim 7 has also been rejected under 35 U.S.C. § 112 for use of the term "control section", the Examiner stating that there is no support in the specification for such a term. Applicants have deleted the use of the term "control section" from claim 7 and accordingly claim 7 is now considered acceptable under 35 U.S.C. § 112.

Claims 1-5 and 9-11 have been rejected under 35 U.S.C. § 112, second paragraph as indefinite by use of the term "relatively". Applicants have deleted the term "relatively" and accordingly, claims 1-5 and 9-11 are now considered to be definite under 35 U.S.C. § 112.

Claims 1 and 4-5 have been rejected as unpatentable over the patent to Iida et al. The Examiner stated that it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida by attempting to optimize the temperature range through routine experimentation. Applicants have cancelled claim 1 and changed the dependencies of claims 4 and 5 and accordingly these issues are considered obviated.

Claim 2 has been rejected under 35 U.S.C. § 103(a) as unpatentable over Iida et al. in view of Luter et al. Applicants have amended claim 2 so that it now recites a V/G value and a G outer/ G center < 1.10 value. Further, the claim recites that such conditions are adjusted by narrowing the distance between the heat shielding element and the silicon melt and pulling the silicon single crystal ingot. This is not found in the art of record and particularly, is not found in either of Iida et al. or Luter et al. who do not narrow the distance between the heat shielding element and the silicon melt.

In addition, Iida et al. only describes numerals or part of the numeral conditions of claim 2 and Luter et al. only describes that the G value changes when the distance between the silicone melt and heat shielding element is changed. Neither reference describes or suggests that the distance between the silicone melt and heat shielding element be narrowed along with pulling up the ingot, which control is unique to the present invention as now recited in claim 2. As a result, Applicants believe that the

invention of claim 2 as amended is not obvious from the combination of Iida et al. and Luter et al.

Claims 1 and 3-5 have been rejected as being unpatentable over the patent to Hourai et al. The Examiner stated that Hourai et al. discloses compensating for the temperature gradient of the crystal by adjusting the pulling rate so that a constant V/G may be achieved. Applicants disagree, noting that Hourai et al. only describes a changing of the pulling speed of the ingot. Hourai et al. neither describes nor suggests that the pulling speed of the ingot might be decreased in conjunction with the pulling of the ingot as set forth in claim 3 and, which control is unique to the subject invention. The Examiner also contends that the subject invention is mere optimization of the technique of Hourai et al. However, on page 13, line 12 through page 14, line 2 of the subject application, the differences between the invention of claim 3 and the technique of Hourai et al. are set forth. As described on page 4, lines 4-13 of the subject application, the technique of Hourai et al. is inefficient and the invention of claim 3 can solve this problem.

Claim 7 has been rejected as unpatentable over Kim et al. in view of Luter. The Examiner stated that it would have been obvious to modify Kim with Luter because counter-rotating the crystal and crucible prevents the exchange of impurities between the melt and directly below the crystal and the residual melt. Applicants have amended claim 7 so that it now recites that the drive mechanism moves the heat-shielding element so that the distance between it and the silicone melt becomes narrower along with the pulling of the silicon single crystal ingot. Neither Kim et al. nor Luter suggest such a feature. Accordingly, Applicants believe claim 7 to now be patentable.

Claims 9-13 have been rejected as being unpatentable over Adachi et al. in view of Iida et al. Examiner has stated that it would have been obvious to modify Adachi et al. by attempting to optimize same by conducting routine experimentation.

One might make the following comparisons between a subject invention and Adachi et al.:

- (a) Heat treatment of the present invention:
 - (i) initial temperature: 500°C or less
 - (ii) ultimate temperature: 700-900°C
 - (iii) temperature ramping rate to ultimate temperature: 1°C/min
 - (iv) treatment target: perfect crystal wafer
 - (v) object (effect): To equalize oxide precipitate density of wafer

The above (i) to (iv) are constituent elements recited in claim 9:

- (b) Heat treatment of Adachi et al.:
 - (i) initial temperature: not described
 - (ii) ultimate temperature: 1100°C
 - (iii) temperature ramping rate to ultimate temperature: 0.5-5°C/min (500-900°C),

- 2-3°C/min (600-800°C)
- (iv) treatment target: wafer having defects
 - (v) object (effect): to remove the defects of wafer

The heat treatment of Adachi et al. is a high temperature heat treatment. The condition "500-900°C" coinciding in part with the present invention is simply one process of increasing the temperature in this high temperature heat treatment. Also the heat treatment according to Adachi et al. is a special treatment in which plural wafers are laminated for treatment. In the first place, heat treatment of the subject invention and that of Adachi et al. differ in the treatment target (iv) and the object (v) as noted from the above comparison. Therefore, it follows that the heat treatment of the subject invention is technically very different from that of Adachi et al. Accordingly, it would not have been obvious to adopt the features of Adachi et al.'s process and optimize them for those of Applicants' process as the objects of both differ greatly.

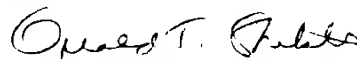
Iida et al. describes an oxygen precipitation processing. One cannot utilize the conditions of an oxygen precipitation process and adopt them to those of a process for removing wafer defects in a nonobvious manner. Accordingly, the present invention would not have been obvious from the subject references.

Applicant hereby requests reconsideration and reexamination thereof.

With the above amendments and remarks, this application is considered ready for allowance and Applicant earnestly solicits an early notice of same. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, he is respectfully requested to call the undersigned at the below-listed number.

Respectfully submitted,

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